

## Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.





# METHODS OF COLLECTING AND PRESERVING POLLEN FOR USE IN THE TREATMENT OF HAY FEVER

By JAMES W. KELLY

*Junior Biochemist, Office of Drug, Poisonous, and Oil Plants, Bureau of  
Plant Industry*

## CONTENTS

|                                    | Page |                                        | Page |
|------------------------------------|------|----------------------------------------|------|
| Introduction -----                 | 1    | Time of pollination -----              | 6    |
| Methods of collecting pollen ----- | 1    | Suggestions to pollen collectors ----- | 8    |
| Yield of pollen -----              | 5    | Literature cited -----                 | 9    |

## INTRODUCTION

As early as 1831 Elliotson (6)<sup>1</sup> suggested, but offered no experimental proof, that hay fever is caused by the flowers of the grasses or by their pollen. This theory was proved to be correct by the experiments of Blackley (2) in 1865 and later by the studies of Wyman (10) in 1872 and those of Marsh (8) in 1877. Dunbar (5) and his coworkers demonstrated in 1902 that the protein of the pollen grains is the active agent in causing the disease. It has been discovered also that protein from the dust of certain seeds and plants and from the dandruff of some animals, such as cats, horses, and rabbits, causes hay fever and asthma in sensitive individuals. Recently Csonka, Bernton, and Jones (3, 4), working with the pollen of certain grasses, have obtained interesting results in the treatment of hay fever with different protein fractions from the same pollen. Other experiments have demonstrated that hay fever can often be treated successfully by the use of extracts prepared from the pollen to which the individual is sensitive. Consequently, there is an increasing demand for wind-borne pollen, and the object of the work herein described is to give information concerning the best methods for collecting such pollens in quantity and in a pure condition.

## METHODS OF COLLECTING POLLEN

Various methods of collecting pollen have been tried in previous years, but they have not always proved entirely satisfactory for providing pollen in quantity and of acceptable purity. Early observers, noticing that pollen is usually shed soon after sunrise, attempted to

<sup>1</sup> Italic numbers in parentheses refer to "Literature cited," p. 9.

gather it in the early morning by shaking it from the plants into containers. In the morning the plants are likely to be wet with dew; therefore only a small proportion of the pollen can be shaken from them. Another method was to place paper bags over the blooms and leave them for several days, after which the bags were removed and the pollen shaken out. This method also has its disadvantage, since the bags trap many small insects which are frequently on flowers at this time and which when released carry with them a considerable portion of the pollen. The bagging method, however, can be used successfully with some plants, such as corn and sorghum. Figure 1 shows a flowering top of ragweed covered with a paper sack in which pollen is to be collected.

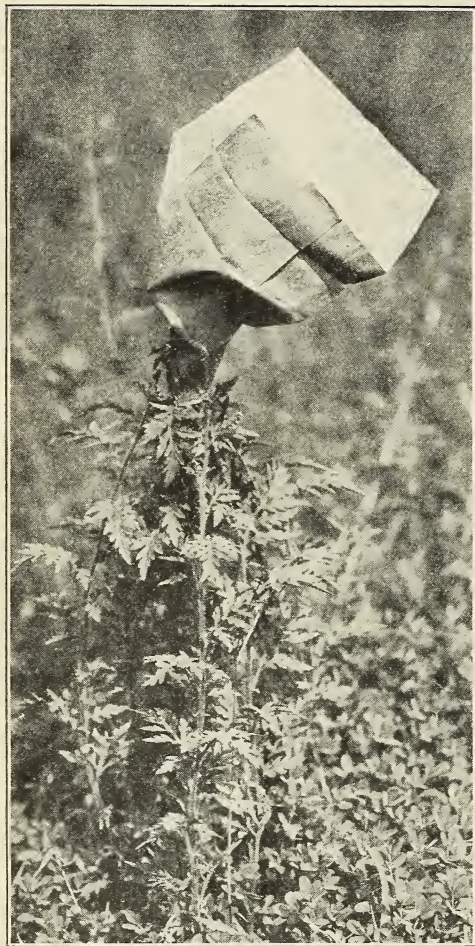


FIG. 1.—Flowering head of ragweed covered with paper bag for the collection of pollen

The writer found that if cut at the proper blooming stage and the stems wrapped in wet burlap or sacks, most of the plants from which he collected pollen can be kept in such condition that the blooms will continue to shed their pollen for hours or even days. Figure 2 shows timothy plants that have been thus handled. One disadvantage, however, is that moisture from the wet covering coming in contact with the pollen frequently causes it to mold or results in the bursting of the grains, thereby causing considerable loss.

Specially designed metal pans or tanks, in which the flowering plants may be kept with the stems in water and the tops projecting over the sides, have also been used to good advantage. The writer has found a long, galvanized metal tank to be most satisfactory. This is so built that the flowering tops lean forward over a sloping front and thus discharge the pollen directly upon the surface below. This surface is covered with glazed paper, from which the pollen can very easily be shaken off into containers. Figure 3 shows an end view of such a tank in which ragweed has been placed, and Figure 4 shows the front view with the blooms hanging over the edge.



FIG. 2.—Timothy plants with stems covered with wet burlap to prevent drying and to increase the yield of pollen

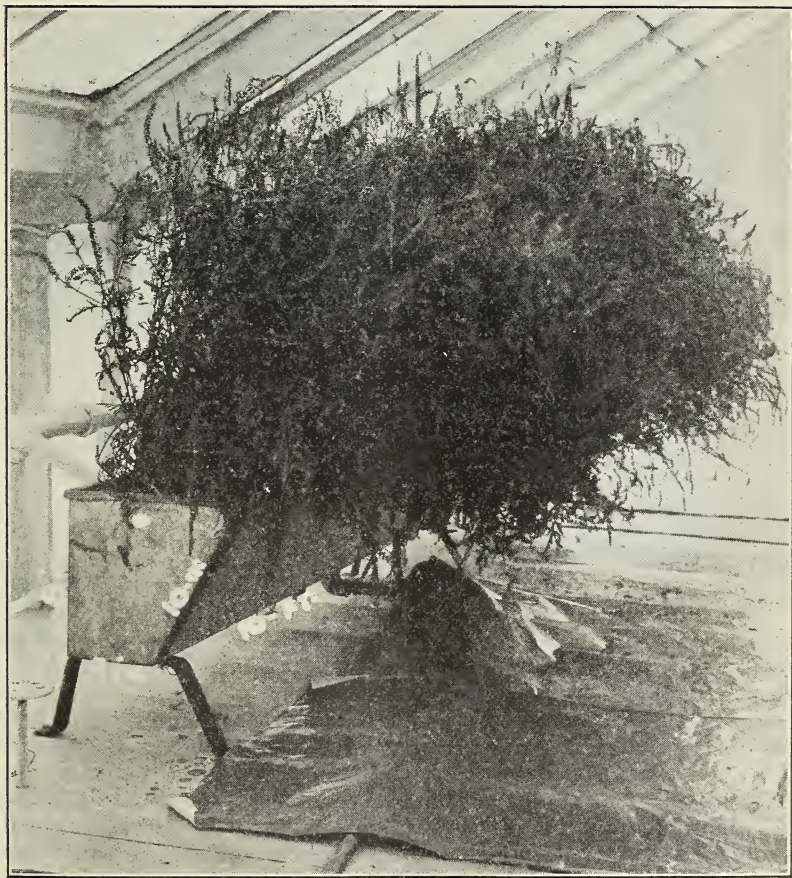


FIG. 3.—End view of tank used for collecting pollen, showing the dimensions

The tank may be made any length desired, but it is important that it be shallow enough to accommodate short-stem as well as long-stem plants. The one illustrated is 10 feet in length, 6 inches wide at the bottom, 8 inches high at the back, with the front piece 10 inches high but leaning forward so that the top is level with the back. A water intake is placed in the center of the bottom, and water outlets are placed in the ends about 1 inch from the top, so that the water may flow in both directions, thereby furnishing the plants with a continuous supply of fresh water. Such a tank keeps plants fresh until all the pollen has been shed.

The advantages of the tank are many: (1) The plants can be cut at any time of day, regardless of weather conditions, and can be kept fresh until all the pollen has been shed; (2) the thin layer of blooms



FIG. 4.—Front view of tank containing ragweed. The blurred appearance at the right is due to a cloud of pollen which was dislodged by agitating the plants by light taps of a stick

permits proper light and ventilation; (3) by hanging over the edge the blooms shed the pollen directly upon the paper with practically no loss; (4) the pollen thus obtained is pure. This tank will be found useful for handling most varieties of flowering plants. Catkins and blooms from pine and sycamore must be handled in a different manner.

To collect pollen of the best quality and in the greatest quantity it is essential that the plants be cut at the proper blooming stage. Figure 5 shows a flowering top of timothy cut in just the right condition. It will be observed that the anthers are full and plump, and when blooms are in this condition the pollen can be easily dislodged with only a slight tap. Grasses, ragweed, hemp, wormseed, and various other plants should be gathered when the blooms are at this stage.

Each day, after the plants have been exposed to the sunlight for several hours, the pollen should be shaken off, then removed from the glazed paper and placed in fine sieves to separate it from any adhering parts of the plants. It should then be placed in shallow pans or dishes and put in a drying oven at a temperature not above 75° C. for 24 hours. Or it may be placed in strong sunlight for several hours until the excess moisture has been removed. After this the pollen should be put into wide-mouthed bottles without stoppers and placed in a desiccator containing strong sulphuric acid and kept there until all traces of moisture have been removed (fig. 6).

The proper stage at which to collect catkins and the blooms of pine and sycamore can be determined by rolling them slightly in the hand. If pollen is deposited they are ready to be gathered. They may be collected in baskets or buckets in the late afternoon and placed in an ice box or in cold storage at a temperature just above freezing. The next day they should be removed and spread in thin layers on the glazed paper away from draft. Soon the anthers open and the pollen is expelled.

It is essential that pollen from each species of plant be kept entirely distinct. Although it is possible to distinguish the different pollens by means of the microscope and by chemical examination, the separation of mixed material would be entirely impracticable. Figure 7 shows pollen grains of orchard grass and ragweed magnified 230 times.

At certain seasons of the year, especially in the late spring, there is a great overlapping of the blooming periods of the several plants, and the pollen may be carried by wind and insects from one species to another. This difficulty, however, can be overcome by shaking the plants gently but thoroughly before collecting them in the late afternoon. This removes whatever pollen may be on the surface, and what is shed later when the plants are placed in the tank will be practically pure.

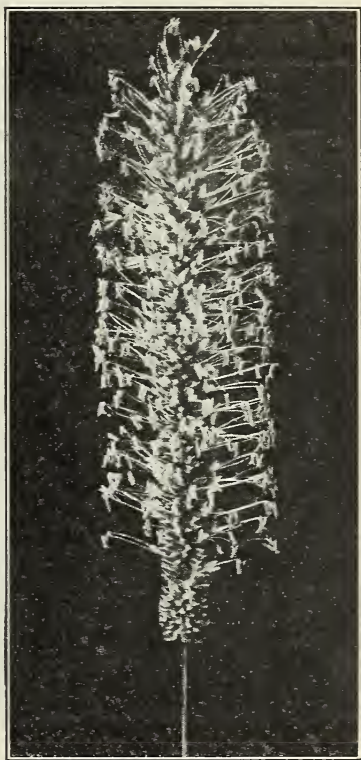


FIG. 5.—A head of timothy in full bloom

#### YIELD OF POLLEN

Information concerning the yield of pollen that may be expected is not generally available. Some data, however, have been obtained in regard to the yield from timothy and ragweed. Timothy plants collected by the writer at the Arlington Experiment Farm, Rosslyn, Va., and at the United States Soldiers' Home, Washington, D. C.,

in the late afternoon were brought to the laboratory with the stems wrapped in moist sacks and placed immediately in the tank of water. Only those plants that were in full bloom were collected. After three days the yield of pollen, calculated on the air-dry weight of the plants, was 0.525 per cent. This yield is much higher than that reported by Evans (7), who collected timothy plants of two varieties from two different areas late one afternoon, and spread them on the floor with the stems wrapped in wet burlap and the flowering heads laid on paper. The next day he observed that only 65 per cent of the plants in the first area were in bloom, whereas in the second area 95 per cent were in bloom. The yield of pollen from the plants of the first area, calculated on the basis of air-dry weight, was about

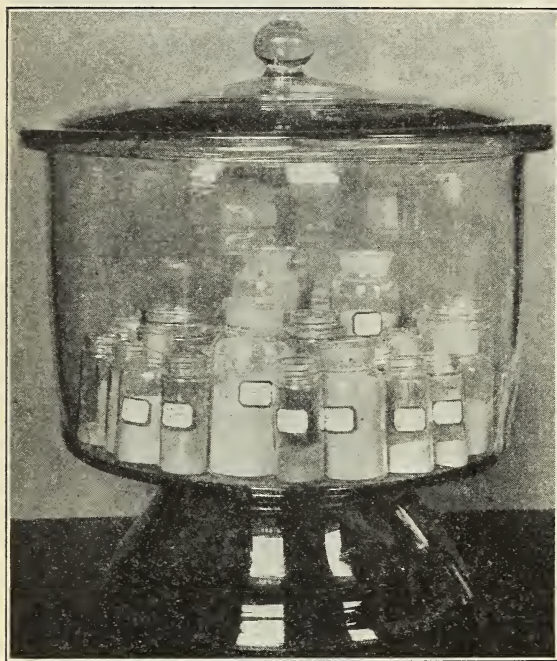


FIG. 6.—Pollen collections in desiccator for the removal of final traces of moisture

0.11 per cent, while from those of the second area the yield was 0.23 per cent. These results would seem to indicate that the yield of pollen depends largely upon the stage of growth at which the plants are cut and the method by which pollen is collected.

At another time two lots of ragweed collected by the writer were kept in the tank six days, and the pollen was collected every other day. The yield of pollen from these two lots was, respectively, 0.125 and 0.157 per cent.

Some plants do not shed pollen in any considerable quantity; others have considerable pollen but only a short blooming period; while still others have a continuous blooming period of several weeks. Assuming, however, that the plants are collected at the proper stage of growth and that the temperature and sunlight have been normal, it may be expected that plants from these various types will yield the maximum quantity of pollen obtainable.

#### TIME OF POLLINATION

The time of pollination varies with the season. If the weather is warm and bright, the blooming period may be considerably advanced; if the weather is cold and damp, late blooming may be

expected. The first large influx of pollen comes from the various trees and shrubs that bloom in the early spring, often before their leaves appear. Catkins from the oak, hickory, walnut, and alder begin to shed large quantities of pollen as early as the middle of March if the weather is favorable, and as a rule the peak is reached by the first to the middle of April. The first grasses like *Poa annua*, begin to bloom in March and continue to shed their pollen until about the middle of May. Other grasses, like sweet vernal, some of the fescues, Kentucky and Canada bluegrasses, orchard grass, redtop, Italian ryegrass, and timothy, in the order named, reach their peaks about the middle of June. Besides these, a great many weedy

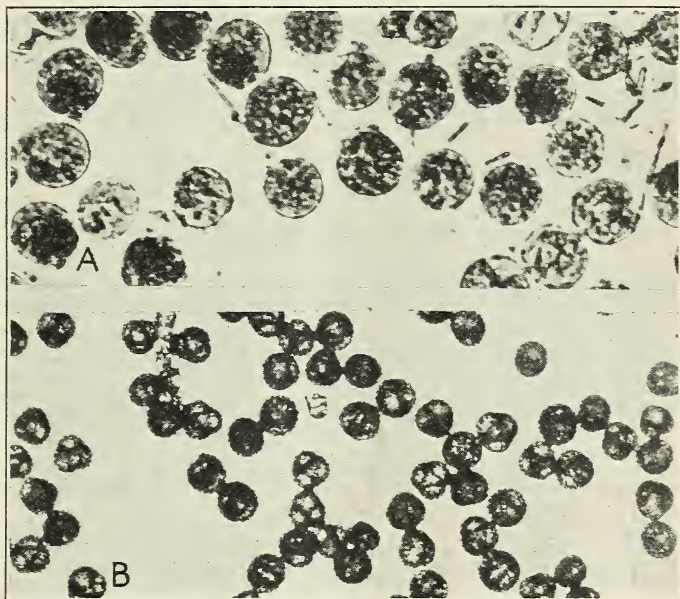


FIG. 7.—Pollen grains of orchard grass (A) and ragweed (B).  $\times 230$

plants, such as the plantains, docks, and sorrels, are blooming at this period and shedding their pollen. About the first of August the ragweeds, artemisias, wormseed, and numerous other weedy plants, together with the fall grasses such as Johnson grass, quack grass, crowfoot, purple top, and numerous others are blooming and shed their pollen until the first heavy frost. A comprehensive list of plants with dates of pollination has been published by Bernton (1) and also by Moore and La Garde (9). A list of the plants that were collected by the writer in the District of Columbia and near-by regions in Virginia and Maryland during the period from 1925 to 1927, inclusive, together with the dates on which the pollen was collected, is shown in Table 1.

TABLE 1.—*Plants from which pollen was collected and periods during which collection was made*

| Botanical name                     | Common name              | Period of pollen collection |                       |                   |
|------------------------------------|--------------------------|-----------------------------|-----------------------|-------------------|
|                                    |                          | 1925                        | 1926                  | 1927              |
| Acer negundo.....                  | Boxelder.....            | -----                       | -----                 | Apr. 20.          |
| Agrostis palustris.....            | Redtop.....              | -----                       | June 24-26.....       | June 3-10.        |
| Alnus rugosa.....                  | Hazel alder.....         | -----                       | -----                 | Mar. 15.          |
| Amaranthus graecizans.....         | Pigweed.....             | July 27-Aug. 15.....        | July 15-Aug. 10.....  | -----             |
| Ambrosia elatior.....              | Small ragweed.....       | Aug. 15-Sept. 15.....       | Aug. 17-Sept. 10..... | Aug. 15-Sept. 15. |
| Ambrosia trifida.....              | Giant ragweed.....       | Sept. 1.....                | Aug. 27-Sept. 10..... | Aug. 15-Sept. 1.  |
| Andropogon halepensis.....         | Johnson grass.....       | -----                       | July 25-Aug. 15.....  | -----             |
| Andropogon sorghum.....            | Sorghum.....             | -----                       | Sept. 10-15.....      | Sept. 10-15.      |
| Andropogon sorghum sudanensis..... | Sudan grass.....         | -----                       | Aug. 10-30.....       | Aug. 10-30.       |
| Cannabis sativa.....               | Hemp.....                | -----                       | July 19-25.....       | July 15-27.       |
| Castanea dentata.....              | Chestnut.....            | -----                       | June 21.....          | -----             |
| Castanea pumila.....               | Chinquapin.....          | -----                       | June 11.....          | -----             |
| Chenopodium album.....             | Lamb's-quarters.....     | Aug. 15-Sept. 1.....        | -----                 | July 15-Sept. 15. |
| Chenopodium ambrosioides.....      | Wormseed.....            | -----                       | Aug. 15-Sept. 15..... | Aug. 15-Sept. 15. |
| Dactylis glomerata.....            | Orchard grass.....       | -----                       | May 19-25.....        | May 23-27.        |
| Danthonia spicata.....             | Whitetop.....            | -----                       | June 1-10.....        | May 29-31.        |
| Echinochloa crusgalli.....         | Barnyard grass.....      | -----                       | July 15-Aug. 10.....  | -----             |
| Ginkgo biloba.....                 | Maidenhair tree.....     | -----                       | -----                 | Apr. 15-20.       |
| Helianthus annuus.....             | Sunflower.....           | -----                       | Aug. 10-31.....       | Aug. 15-31.       |
| Hicoria myristicæformis.....       | Nutmeg hickory.....      | -----                       | May 26.....           | May 2-10.         |
| Hicoria pecan.....                 | Pecan.....               | -----                       | -----                 | May 25-31.        |
| Juglans nigra.....                 | Black walnut.....        | -----                       | -----                 | May 19-30.        |
| Liquidambar styraciflua.....       | Sweet gum.....           | -----                       | -----                 | Apr. 19-20.       |
| Lolium multiflorum.....            | Italian ryegrass.....    | -----                       | June 1-15.....        | June 1-12.        |
| Notholcus lanatus.....             | Velvet grass.....        | -----                       | June 1-10.....        | June 10-23.       |
| Phleum pratense.....               | Timothy.....             | June 18-26.....             | June 24-26.....       | June 10-20.       |
| Pinus sylvestris.....              | Scotch pine.....         | -----                       | -----                 | May 5-10.         |
| Pinus virginiana.....              | Scrub pine.....          | -----                       | -----                 | Do.               |
| Plantago lanceolata.....           | Rib grass.....           | June 20-July 31.....        | June 25-July 31.....  | June 25-July 31.  |
| Plantago rugelii.....              | Broad-leaf plantain..... | -----                       | do.....               | -----             |
| Platanus occidentalis.....         | Sycamore.....            | -----                       | -----                 | Apr. 27-30.       |
| Poa compressa.....                 | Canada bluegrass.....    | May 17-26.....              | May 17-20.....        | May 19-31.        |
| Poa pratensis.....                 | Kentucky bluegrass.....  | June 1-6.....               | May 17-26.....        | May 27-31.        |
| Quercus alba.....                  | White oak.....           | -----                       | -----                 | May 1-10.         |
| Quercus velutina.....              | Black oak.....           | -----                       | -----                 | Apr. 20-30.       |
| Rumex acetosella.....              | Sheep sorrel.....        | May 17-26.....              | May 18-31.....        | May 19-June 15.   |
| Rumex crispus.....                 | Narrow-leaf dock.....    | -----                       | June 3-July 31.....   | -----             |
| Sambucus canadensis.....           | Elder.....               | July 10-15.....             | July 1-15.....        | -----             |
| Secale cereale.....                | Rye.....                 | June 1-21.....              | May 6-20.....         | May 6-20.         |
| Tilia americana.....               | American linden.....     | -----                       | June 19-25.....       | -----             |
| Zea mays.....                      | Corn.....                | July 29-Aug. 10.....        | Aug. 15-17.....       | Aug. 15-17.       |

## SUGGESTIONS TO POLLEN COLLECTORS

The collecting of pollen must be carefully and intelligently done, since the necessity for furnishing a pure product can hardly be overestimated. If the collector is not a botanist it is necessary that he be thoroughly instructed by a competent person regarding the identity of the plants from which the pollen is to be collected. It is true that the pollen from the different plants can generally be identified microscopically, but the collector must not depend on this means of controlling his work.

The most practicable plan for pollen collection which seems to have been adopted by firms requiring this material is to engage reliable individuals for the collection of whatever pollens are required in the localities where the supply is abundant. Proper instruction for

the person engaged, especially with reference to the identification of the plants from which collections are to be made, should be provided before the work is actually undertaken.

## LITERATURE CITED

- (1) BERNTON, H. S.  
1923. STUDIES IN HAY FEVER. *Va. Med. Mo.* 50: 41-43.
- (2) BLACKLEY, C. H.  
1880. HAY FEVER; ITS CAUSES, TREATMENT, AND EFFECTIVE PREVENTION. Ed. 2, rev. and enl., 281, p., illus. London, Paris [etc.].
- (3) CSONKA, F. A., BERNTON, H. S., and JONES, D. B.  
1925. PROTEINS OF TIMOTHY AND ORCHARD GRASS POLLEN AND THEIR RELATION TO VERNAL HAY FEVER. *Soc. Expt. Biol. and Med. Proc.* 23: 14-16.
- (4) ——— BERNTON, H. S., and JONES, D. B.  
1927. POLLEN PROTEINS AND THEIR CLINICAL SIGNIFICANCE IN HAY FEVER. *South. Med. Jour.* 20: 257-264.
- (5) DUNBAR, W. P.  
1903. ZUR URSACHE UND SPECIFISCHEN HEILUNG DES HEUFIEBERS. 60 p., illus. München and Berlin.
- (6) ELLIOTSON.  
1831. HAY-FEVER—INFORMATION SOLICITED. *London Med. Gaz.* 8: 411-413.
- (7) EVANS, M. W.  
1916. THE FLOWERING HABITS OF TIMOTHY. *Jour. Amer. Soc. Agron.* 8: 299-309, illus.
- (8) MARSH, E. J.  
1877. HAY FEVER, OR POLLEN POISONING. *Med. Soc. N. J. Trans.* 1877: [86]-109.
- (9) MOORE, G. T., and LA GARDE, R. V. L.  
1926. THE IDENTIFICATION OF POLLEN FROM SO-CALLED "HAY FEVER" PLANTS. *Ann. Missouri Bot. Gard.* 13: 355-390.
- (10) WYMAN, M.  
1872. AUTUMNAL CATARRH (HAY FEVER). 173 p., illus. New York and Cambridge.

# ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

September 24, 1928

---

|                                                                |                                                                               |
|----------------------------------------------------------------|-------------------------------------------------------------------------------|
| <i>Secretary of Agriculture</i> -----                          | W. M. JARDINE.                                                                |
| <i>Assistant Secretary</i> -----                               | R. W. DUNLAP.                                                                 |
| <i>Director of Scientific Work</i> -----                       | A. F. WOODS.                                                                  |
| <i>Director of Regulatory Work</i> -----                       | WALTER G. CAMPBELL.                                                           |
| <i>Director of Extension</i> -----                             | C. W. WARBURTON.                                                              |
| <i>Director of Personnel and Business Administration</i> ----- | W. W. STOCKBERGER.                                                            |
| <i>Director of Information</i> -----                           | NELSON ANTRIM CRAWFORD.                                                       |
| <i>Solicitor</i> -----                                         | R. W. WILLIAMS.                                                               |
| <i>Weather Bureau</i> -----                                    | CHARLES F. MARVIN, <i>Chief</i> .                                             |
| <i>Bureau of Animal Industry</i> -----                         | JOHN R. MOHLER, <i>Chief</i> .                                                |
| <i>Bureau of Dairy Industry</i> -----                          | O. E. REED, <i>Chief</i> .                                                    |
| <i>Bureau of Plant Industry</i> -----                          | WILLIAM A. TAYLOR, <i>Chief</i> .                                             |
| <i>Forest Service</i> -----                                    | R. Y. STUART, <i>Chief</i> .                                                  |
| <i>Bureau of Chemistry and Soils</i> -----                     | H. G. KNIGHT, <i>Chief</i> .                                                  |
| <i>Bureau of Entomology</i> -----                              | C. L. MARLATT, <i>Chief</i> .                                                 |
| <i>Bureau of Biological Survey</i> -----                       | PAUL G. REDINGTON, <i>Chief</i> .                                             |
| <i>Bureau of Public Roads</i> -----                            | THOMAS H. MACDONALD, <i>Chief</i> .                                           |
| <i>Bureau of Agricultural Economics</i> -----                  | NILS A. OLSEN, <i>Chief</i> .                                                 |
| <i>Bureau of Home Economics</i> -----                          | LOUISE STANLEY, <i>Chief</i> .                                                |
| <i>Plant Quarantine and Control Administration</i> -----       | C. L. MARLATT, <i>Chief</i> .                                                 |
| <i>Grain Futures Administration</i> -----                      | J. W. T. DUVEL, <i>Chief</i> .                                                |
| <i>Food, Drug, and Insecticide Administration</i> -----        | WALTER G. CAMPBELL, <i>Director of</i><br><i>Regulatory Work, in Charge</i> . |
| <i>Office of Experiment Stations</i> -----                     | E. W. ALLEN, <i>Chief</i> .                                                   |
| <i>Office of Cooperative Extension Work</i> -----              | C. B. SMITH, <i>Chief</i> .                                                   |
| <i>Library</i> -----                                           | CLARIBEL R. BARNETT, <i>Librarian</i> .                                       |

---

This circular is a contribution from

|                                                        |                                                                         |
|--------------------------------------------------------|-------------------------------------------------------------------------|
| <i>Bureau of Plant Industry</i> -----                  | WILLIAM A. TAYLOR, <i>Chief</i> .                                       |
| <i>Office of Drug, Poisonous, and Oil Plants</i> ----- | W. W. STOCKBERGER, <i>Principal</i><br><i>Physiologist, in Charge</i> . |

10

---

ADDITIONAL COPIES  
OF THIS PUBLICATION MAY BE PROCURED FROM  
THE SUPERINTENDENT OF DOCUMENTS  
U.S. GOVERNMENT PRINTING OFFICE  
WASHINGTON, D. C.  
AT  
5 CENTS PER COPY  
▽



